REPORT / RECOMMENDATION

To: Edina Transportation Commission

Agenda Item #: VI. B.

From: Mark K. Nolan, AICP, Transportation Planner

Action ☒
Discussion ☐
Information ☐

Date: May 15, 2014

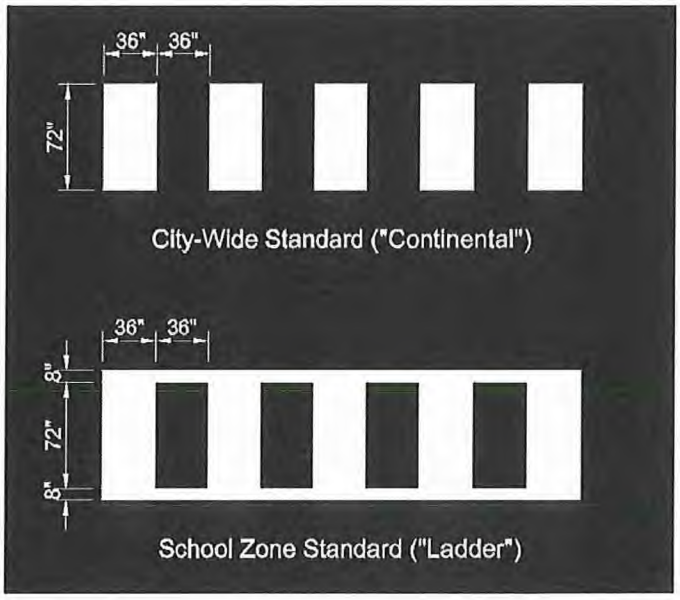
Subject: Recommendation for Marked Crosswalk Standards

Action Requested:
Review, discuss and forward recommendations for crosswalk standards to City Council.

Information / Background:
At the February 3, 2014 City Council meeting, during a discussion of the draft Active Routes to School Plan, Councilmembers requested staff to study and make recommendations to standardize how crosswalks shall be marked city-wide in the future. Engineering and Public Works staff have met several times since then to discuss the feasibility, effectiveness and costs of varying crosswalk marking types, patterns and materials installed both by City staff and by contractors.

Recommended Marked Crosswalk Pattern

Staff is recommending the City of Edina adopt standards for marked crosswalks as determined by context and the following general principles:



- City-wide standard (Continental) crosswalk: 36-inch wide x 72-inch long painted blocks, spaced at 36-inch intervals.
- School zone standard (Ladder): Same as Continental (above), with 8-inch lateral painted lines.
- Specialty crosswalks: May include brick inlay crosswalks (such as in the Countryside Neighborhood), colored concrete crosswalks (50th & France district) or existing patterned Duratherm crosswalks (to be phased out in the future).

The "continental" marking pattern is not only currently used by City Public Works staff but also Hennepin County on county roads in Edina and in many other metro communities. This creates a consistent user experience for both pedestrians and vehicles. The size and spacing of the blocks allows for placement such that the pavement markings are spaced outside of the wheel lanes of vehicles, extending the useful life of the markings. It may be necessary to adjust the spacing of the blocks slightly to accommodate this (a commonly-used practice that City staff currently uses).

The school zone "ladder" standard will add 8-inch lateral painted lines to the standard "continental" crosswalk markings. Staff believes this addition will indicate a "higher level" crossing at and near schools.

Types of Materials

Four primary types of crosswalk marking materials were considered and studied by staff in preparation for this report: latex paint, epoxy paint, standard thermoplastic and DuraTherm thermoplastic. All four have differing physical characteristics, application processes and costs associated with their installation. The following are brief descriptions of each type.

Latex paint: Latex is a waterborne compound that is currently used for the vast majority of crosswalk markings in Edina. Latex is the least expensive of the four marking materials considered but also the least durable. City staff must re-apply most of the City's latex crosswalk blocks each year, as they become worn by weather, traffic and snow plow operations. However, in addition to its lower material costs, latex paint dries quicker and is easier to apply and clean the equipment. Latex paint also has wider operating temperature parameters, allowing its application in colder or warmer temperatures.

Epoxy paint: Epoxy is a product made of two parts: color and catalyst, and requires the use of solvents to clean its application equipment. The applied product looks similar to latex paint but has an increased life span (three to five years); however, the product costs over three times as much as the equivalent amount of latex paint. Epoxy is much more sensitive to temperature in its application and drying time than latex. Equipment costs are also considerably higher than for latex paint.

Thermoplastic: Thermoplastic pavement markings are plastic "decals" that become liquid when heated, then solid when cool. It is installed using heating equipment to preheat and apply the material. Thermoplastic markings have higher durability/life span (five to eight years) and retain their reflectivity well when compared to latex and epoxy paints. Installation requires special equipment and/or the use of contractors, depending on the amount and need.

DuraTherm thermoplastic: DuraTherm is a specific brand of thermoplastic that has been used in over 40 crosswalks in Edina over the past several years. It is installed by inlaying the product into asphalt that is imprinted through the use of applied heat, resulting in a pattern that is level to or slightly below the finished roadway surface. DuraTherm is more expensive to purchase and apply when compared to other pavement marking types; however, the technology used allows for more intricate patterns and colors. Replacement costs can be higher, since the old markings must be removed and a new crossing re-applied.

Recommended Crosswalk Marking Material

After consideration, staff is recommending that the City continue its use of latex paint for its typical crosswalk markings. However, some locations may require the additional durability provided by thermoplastic markings. Thus staff is recommending their use at crossing locations that experience a higher level of motor vehicle traffic and turning movements, where crosswalk markings tend to wear away more rapidly.

Staff is recommending that the use of DuraTherm thermoplastic for City crosswalks be discontinued, with existing crosswalks replaced with the citywide or school zone standard (see above) when their useful life has ended. This is due to several factors, including its high installation and equipment costs, difficult application process, relatively low visibility a few years after installation, and other factors as discussed above.

Additionally, staff is recommending against the use of epoxy paint for the City's crosswalk markings. While its life span is longer than for latex paint, the material costs of epoxy paint (including the required catalyst) is up to 375% higher than for the equivalent amount of latex paint (an estimated yearly materials cost difference of $11,375 – see Table 1).

Table 1. Material Costs for Latex and Epoxy Paint

Material (Paint) Cost			
Product	Amount* (gallons)	Cost** (per gallon)	Total Material Cost
Latex paint	500	$8.25	$4,125
Epoxy paint	500	$31.00	$15,500

* 500 gallons of white paint used in 2013 for crosswalks, turn arrows, bike symbols and stop bars

** Includes required catalyst (for epoxy) and glass beads

Moreover, the costs associated with purchasing equipment for epoxy paint pavement marking installation is considerable when compared to latex paint and thermoplastic pavement markings. Table 2 below indicates that no additional equipment is necessary for the continued use of latex pavement markings (except for new grinding blades each year), while both epoxy and thermoplastic require new equipment. Including $50,000 in improvements needed for storage of solvents and other hazardous material associated with it, equipment costs for epoxy paint are over $200,000 higher than latex and nearly so when compared to thermoplastic equipment.

Table 2. Installation Equipment Costs for Crosswalk Pavement Marking Types

	Equipment Cost					
Product	Equipment	Equipment Cost	Storage Improvement Cost (Hazardous Material)	Grinder Cost	Grinder Blade Sets	Total Equipment Cost
Latex					$3,000	$3,000
Epoxy	EPO-60 Epoxy Detail Marking System	$155,000	$50,000	$4,000	$6,000	$215,000
Thermoplastic	SR-28 Heater	$8,000		$4,000	$6,000	$18,000

Of the remaining two crosswalk marking materials (latex and thermoplastic), staff compared life-cycle installation costs (materials and labor – Figure 1) over a 20-year period. For the analysis, the existing crosswalk at the north leg of the intersection of York Avenue South and W. 76th Street was used. The chart below reflects the costs associated with replacing this "continental" crosswalk, which consists of 18 standard blocks.

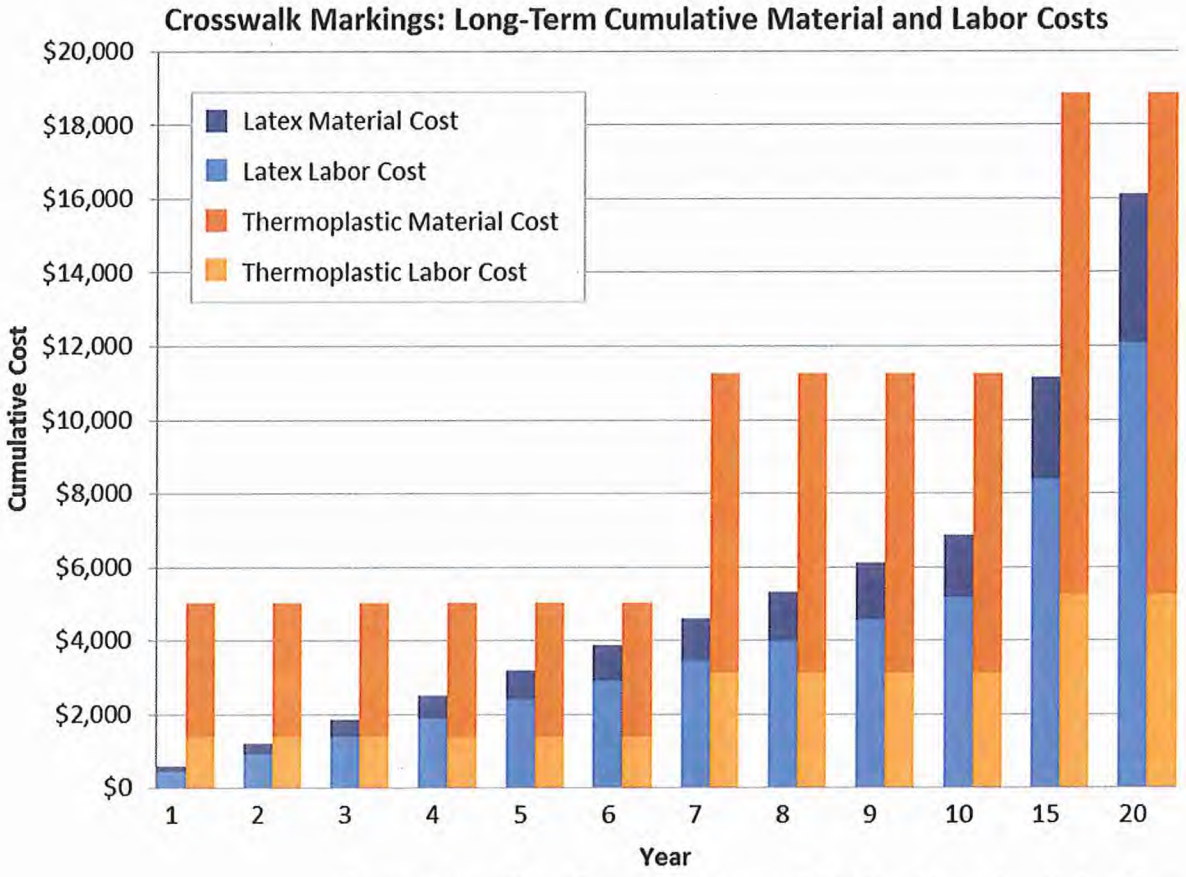


Figure 1. Long-Term Cumulative Crosswalk Marking Material and Labor Costs

Figure 1 shows that while latex pavement markings have to be repainted each year on average, thermoplastic pavement markings have an average life span of seven years. Thus, while both material and labor costs are higher when installing a crossing with thermoplastic, by the fourth year cumulative labor costs for installing latex crosswalks have surpassed thermoplastic, and long term (20-year) total cumulative material and labor costs are much closer. Additionally, cumulative time spent by staff by year 20 is more than doubled for latex paint vs. thermoplastic crosswalk markings. This is important when considering the opportunity costs of labor and the safety concerns of spending time exposed to traffic when installing crosswalks.

Funding

Staff is of the opinion that crosswalk markings are directly related to pedestrian safety. Staff is recommending the initial equipment purchase and material cost for the first year of thermoplastic installation is funded by the Pedestrian and Cyclist Safety (PACS) Fund. Continued equipment maintenance and material costs after year one would be borne by Public Works from their yearly maintenance budgets.

If Council approves this crosswalk standard in June, staff believes equipment and materials could be purchased in time to begin some installation during the second half of 2014.

Attachments:
Minnesota Manual on Uniform Traffic Control Devices: 3B.18 – Crosswalk Markings
Public Works Staff Research Summary: Epoxy vs. Latex

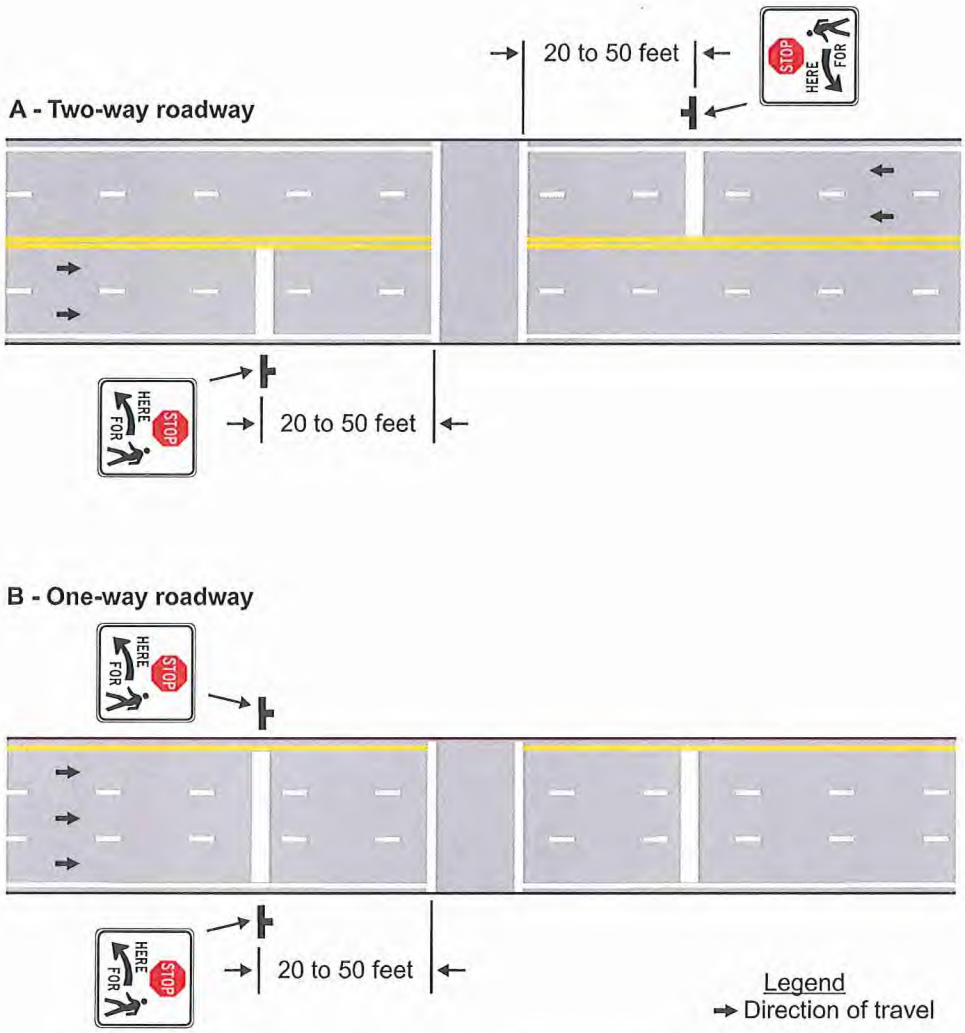


Figure 3B-17 Examples of Stop Lines at Unsignalized Midblock Crosswalks

STANDARD:

If used, Do Not Block Intersection markings (see Figure 3B-18) shall consist of one of the following alternatives:

A. Wide solid white lines that outline the intersection area that vehicles must not block;
B. Wide solid white lines that outline the intersection area that vehicles must not block and a white word message such as DO NOT BLOCK or KEEP CLEAR;
C. Wide solid white lines that outline the intersection area that vehicles must not block and white cross-hatching within the intersection area; or
D. A white word message, such as DO NOT BLOCK or KEEP CLEAR, within the intersection area that vehicles must not block.

Do Not Block Intersection markings shall be accompanied by one or more Do Not Block Intersection (DRIVEWAY) (CROSSING) (R10-7) signs (see Section 2B.53), one or more Do Not Stop On Tracks (R8-8) signs (see Section 8B.9), or one or more similar signs.

3B.18 Crosswalk Markings

SUPPORT:

Crosswalk markings provide guidance for pedestrians who are crossing roadways by defining and delineating paths on approaches to and within signalized intersections, and on approaches to other intersections where traffic stops.

In conjunction with signs and other measures, crosswalk markings help to alert road users of a designated pedestrian crossing point across roadways at locations that are not controlled by traffic control signals or STOP or YIELD signs.

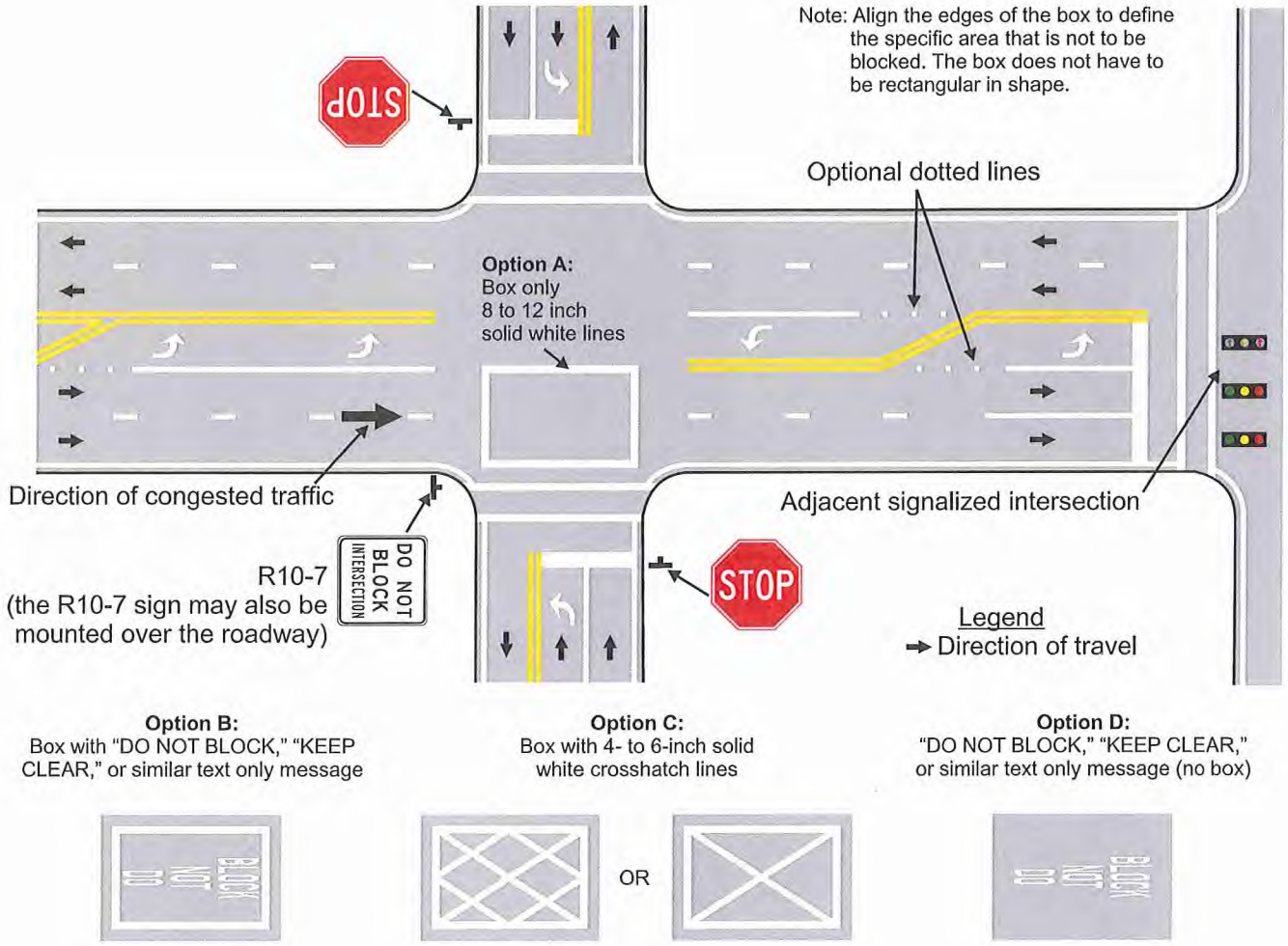


Figure 3B-18 Do Not Block Intersection Markings

At non-intersection locations, crosswalk markings legally establish the crosswalk.

STANDARD:

When crosswalk lines are used, they shall consist of solid white lines that mark the crosswalk. They shall not be less than 6 inches or greater than 24 inches in width.

GUIDANCE:

If transverse lines are used to mark a crosswalk, the gap between the lines should not be less than 6 feet. If diagonal or longitudinal lines are used without transverse lines to mark a crosswalk, the crosswalk should be not less than 6 feet wide.

Crosswalk lines, if used on both sides of the crosswalk, should extend across the full width of pavement to the edge of the intersecting crosswalk to discourage diagonal walking between crosswalks (see Figure 3B-17 and 3B-19).

At locations controlled by traffic control signals or on approaches controlled by STOP or YIELD signs, crosswalk lines should be installed where engineering judgment indicates they are needed to direct pedestrians to the proper crossing path(s).

Crosswalk lines should not be used indiscriminately. An engineering study should be performed before a marked crosswalk is installed at a location away from a traffic control signal or an approach controlled by a STOP or YIELD sign. The engineering study should consider the number of lanes, the presence of a median, the distance from adjacent signalized intersections, the pedestrian volumes

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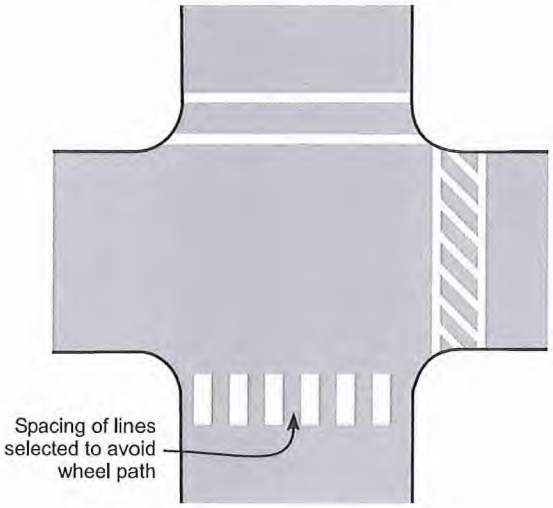

Figure 3B-19 Examples of Crosswalk Markings

and delays, the average daily traffic (ADT), the posted or statutory speed limit or 85th-percentile speed, the geometry of the location, the possible consolidation of multiple crossing points, the availability of street lighting, and other appropriate factors.

New marked crosswalks alone, without other measures designed to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence, should not be installed across uncontrolled roadways where the speed limit exceeds 40 mph and either:

A. The roadway has four or more lanes of travel without a raised median or pedestrian refuge island and an ADT of 12,000 vehicles per day or greater; or
B. The roadway has four or more lanes of travel with a raised median or pedestrian refuge island and an ADT of 15,000 vehicles per day or greater.

SUPPORT:

Chapter 4F contains information on Pedestrian Hybrid Beacons. Section 4L.3 contains information regarding Warning Beacons to provide active warning of a pedestrian's presence. Section 4N.2 contains information regarding In-Roadway Warning Lights at crosswalks. Chapter 7D contains information regarding school crossing supervision.

GUIDANCE:

Because non-intersection pedestrian crossings are generally unexpected by the road user, warning signs (see Section 2C.50) should be installed for all marked crosswalks at non-intersection locations and adequate visibility should be provided by parking prohibitions.

SUPPORT:

Section 3B.16 contains information regarding placement of stop line markings near crosswalk markings.

OPTION:

For added visibility, the area of the crosswalk may be marked with white diagonal lines at a 45-degree angle to the line of the crosswalk or with white longitudinal lines parallel to traffic flow as shown in Figure 3B-19.

When diagonal or longitudinal lines are used to mark a crosswalk, the transverse crosswalk lines may be omitted. This type of marking may be used at locations where substantial numbers of pedestrians cross without any other traffic control device, at locations where physical conditions are such that added visibility of the crosswalk is desired, or at places where a pedestrian crosswalk might not be expected.

GUIDANCE:

If used, the diagonal or longitudinal lines should be 12 to 24 inches wide and separated by gaps of 12 to 60 inches. The design of the lines and gaps should avoid the wheel paths if possible, and the gap between the lines should not exceed 2.5 times the width of the diagonal or longitudinal lines.

OPTION:

When an exclusive pedestrian phase that permits diagonal crossing is provided at a traffic control signal, a marking as

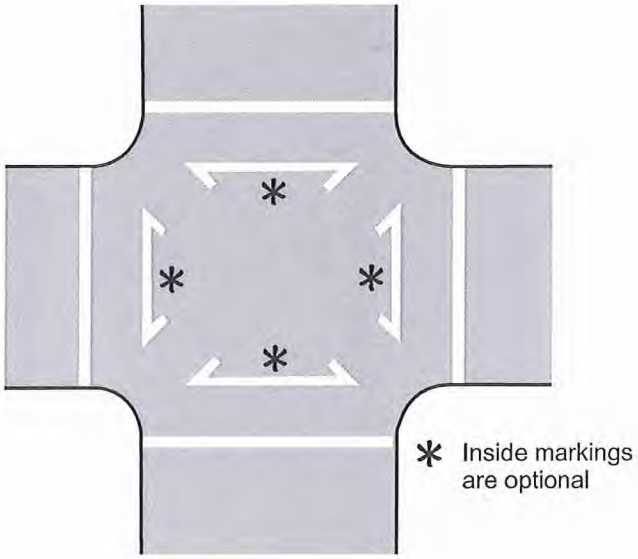

Figure 3B-20 Examples of Crosswalk Markings for an Exclusive Pedestrian Phase That Permits Diagonal Crossing

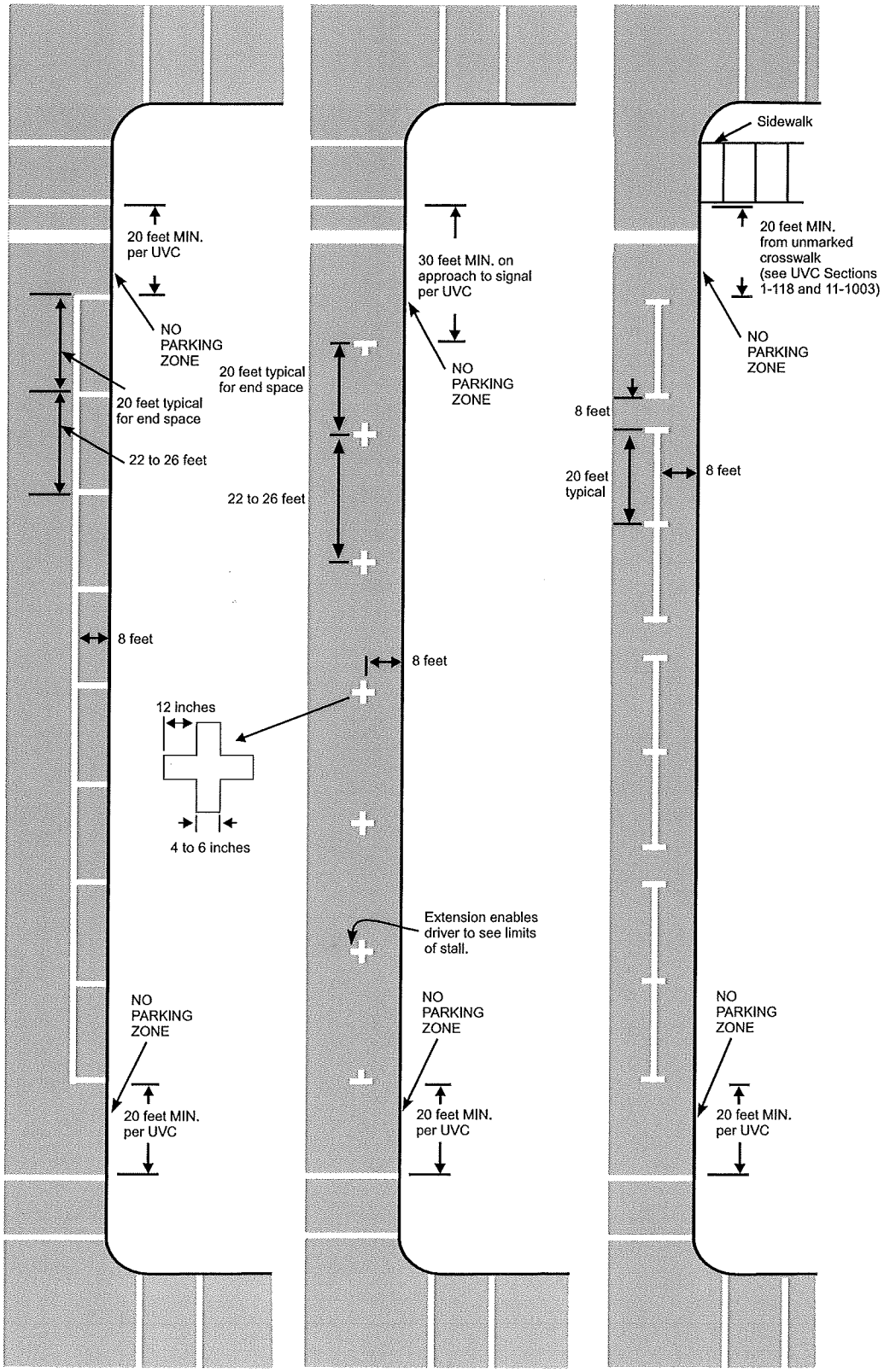

Figure 3B-21 Examples of Parking Space Markings

shown in Figure 3B-20 may be used for the crosswalk.

GUIDANCE:

Crosswalk markings should be located so that the curb ramps are within the extension of the crosswalk markings.

SUPPORT:

Detectable warning surfaces mark boundaries between pedestrian and vehicular ways where there is no raised curb. Detectable warning surfaces are required by 49 CFR, Part 37 and by the Americans with Disabilities Act (ADA) where curb ramps are constructed at the junction of sidewalks and the roadway, for marked and unmarked crosswalks. Detectable warning surfaces contrast visually with adjacent walking surfaces, either light-on- dark, or dark-on-light. The "Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG)" (see Section 1A.11) contains specifications for design and placement of detectable warning surfaces.

3B.19 Parking Space Markings

SUPPORT:

Marking of parking space boundaries encourages more orderly and efficient use of parking spaces where parking turnover is substantial. Parking space markings tend to prevent encroachment into fire hydrant zones, bus stops, loading zones, approaches to intersections, curb ramps, and clearance spaces for islands and other zones where parking is restricted. Examples of parking space markings are shown in Figure 3B-21.

STANDARD:

Parking space markings shall be white.

OPTION:

Blue lines may supplement white parking space markings of each parking space designated for use only by persons with disabilities.

SUPPORT:

Additional parking space markings for the purpose of designating spaces for use only by persons with disabilities are discussed in Section 3B.20 and illustrated in Figure 3B-22. The design and layout of accessible parking spaces for persons with disabilities is provided in the "Americans with Disabilities Act Accessibility Guidelines (ADAAG)" (see Section 1A.11).

3B.20 Pavement Word, Symbol, and Arrow Markings

SUPPORT:

Word, symbol, and arrow markings on the pavement are used for the purpose of guiding, warning, or regulating traffic. These pavement markings can be helpful to road users in some locations by supplementing signs and providing additional emphasis for important regulatory, warning, or guidance messages, because the markings do not require diversion of the road user's attention from the

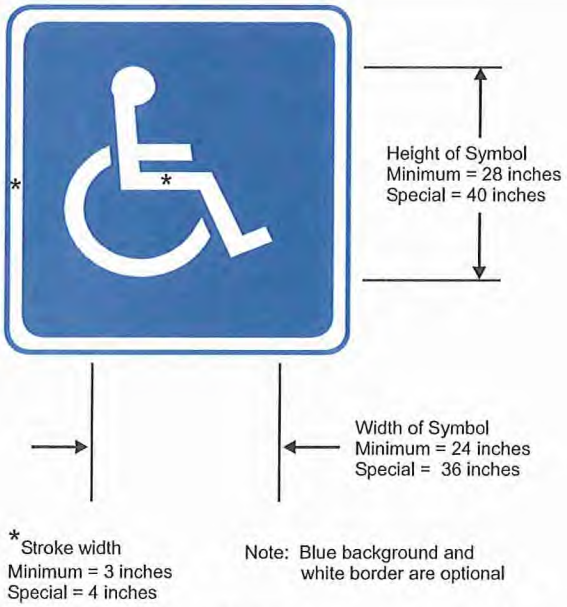

Figure 3B-22 International Symbol of Accessibility Parking Space Marking

City of Edina

Epoxy Vs. Latex

Research Summary

City of Edina

3/10/2014

The contents of this document include an overview of the product characteristics, applications, pros and cons and specific equipment related to operations. Included are also estimated costs associated with both applications.

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Product Overview

Epoxy

- Product is made up of two parts, Color and Catalyst and is mixed at a 2:1 ratio. Every two gallons of color requires 1 gallon of hardener/catalyst.
- Color is a mixture of plastics and polymers that include diluted amounts of the chemicals Toluene and Xylene.
- Once reacted virtually nothing will reverse the hardening process
- Requires Xylene solvent to clean any un-reacted product.
- Extremely sensitive to temperature which affects the rate of time required for successful mixture of color and catalyst
- Extremely sensitive to temperature which affects the rate of time required for successful application and cure of product.
- Pertaining to road applications the surface that is to be bonded needs to be clean of any oils, resins, rubber, dust, dirt etc. Thus making the most desired surface to be ground and rough. It will only be as good as the surface that the epoxy will be bonding to.
- According to MNDOT report findings epoxy requires increased application of beads in order to attain the desired retro reflectivity.
- Epoxy paint requires 25lbs of beads applied for every gallon of paint applied
- There are two different types of epoxy: Slow cure has a dry time of 45 minutes or less at most desirable operating temperatures. Fast Cure has a dry time of less than 10 minutes at most desirable operating temperatures.
- The nature of the product and application methods requires more maintenance of specialized equipment than that of traditional methods, in turn generating substantially higher maintenance costs.
- Life Span of 3-5 years

Latex

- Product is a waterborne compound that is made up of pigments mixed in with paint fillers which could be clay, diatomaceous earth or lime. The paint mixture is then mixed with acrylic polymer emulsions to create the water washable mixture.
- Clean up can be completed with water alone since product is of water soluble base.
- Not as sensitive to temperature for application and drying, wider operating temperature parameters.
- According to MNDOT report findings Latex requires less beads than other methods
- Latex paint requires 8 lbs of beads applied for every gallon of paint.
- Pertaining to road applications the surface that is to be bonded needs to be clean of any oils, resins, rubber, dust, dirt etc. It will only be as good as the surface that the epoxy will be bonding to.

Application Process

Epoxy

For the purpose of painting all Crosswalks, Turn arrows, bike lane symbols and stop bars throughout the City of Edina information was collected and based on the purchase of a chassis mounted Epoxy marking unit or similar system. The Unit requires a 72" x 92" platform for an 80,000 BTU diesel fired heating system with heat exchangers and hose to properly heat and maintain operating temperature of all product and catalyst. *(See MB EPO-60 attachment for Specs)*

- Before product can be applied to the road surface all markings, and abrasives must be removed from the road surface by grinding or water blasting. Once the surface has been prepped only then can the product be applied.
- The application of Epoxy paint is very temperature sensitive. Epoxy needs an air and pavement temperature of 50 degrees and rising. Optimal ambient temperatures of 75 degrees and higher are most desirable.
- At the beginning of every striping operation the color and catalyst must be heated to a minimum temperature of 90 degrees which takes about 1-1.5 hrs. Both the color and catalyst must be heated to the same exact temperature for optimal bonding to occur.

There are two different types of mixing of Epoxy and Catalyst that occur:

- **Static Mixing of Epoxy-** The heated materials of Color and Catalyst are pumped individually to a static mixing chamber located in the actual spray gun. The color and catalyst are mixed at a ratio of 2:1, 2 gallons of color to one gallon of catalyst. From this chamber the mixture is pumped to the nozzle. The operator has mere minutes to dispense the material before it will not bond to the roadway or cause equipment malfunction as it becomes too hard to flow through the lines and gun nozzle.
- **Impingement Mixing of Epoxy-**The heated materials of Color and Catalyst are pumped individually to a mixing chamber located directly inside of the spray gun just before the static mixing chamber. The product and the catalyst are mixed at a ratio of 2:1. The operator has a maximum window of 90 seconds to dispense the material before it will not bond to the roadway or cause equipment malfunction.

(The two mixing chambers, the Impingement Mixing and static mixing are desirable because the color and catalyst never begin to mix until they have reached the impingement chamber within the gun. This eliminates the undesired mixing further back in the lines of the system which could lead to the replacement of the lines that carry the product or the mixing chamber itself. If a malfunction does occur, the gun can be replaced saving time and money.)

- Once the product has been applied to the road surface beads are shaken on by hand. The beads should be applied at a rate of 25lbs for every gallon of paint dispensed. This rate will provide a retro reflectivity rating of 300 mcd/m2/lux white.

Latex

The City of Edina currently uses mid-durable latex traffic paint for its entire pavement marking applications. The application process is much simpler for all markings in the roadway. The equipment consists of a 6' x 8' trailer that contains the paint machine and a 50 foot hose reel. The main feed tube is placed directly into a five gallon pail of paint with a dual filtration system on the end of the feeder tube, machine is then primed and product can be applied.

- Before product can be applied the road surface has to be free of abrasives but does not have to be ground or water blasted. The product can be applied to smooth surfaces although sub surface markings will ultimately increase the life span of the product. Once surface has been prepped only then can the product be applied.
- The application of latex is not as temperature sensitive, the product does not need to be heated to specific temperatures making the product versatile in many climates. Ambient air and pavement temperatures of 40 degrees and rising are still within operational requirements. Ideal ambient temperatures of 60 degrees and higher are ideal operating parameters.
- From the beginning to the end of a striping operation the process is very simple and very little prep time involved before working with the product. Since latex is a water soluble product it cleans very easily and allows crews to quickly adapt to changing conditions in the field.
- Once the product has been applied to the road surface beads are dispensed by shaking on by hand. The beads should be applied at a rate of 8lbs for every gallon of paint dispensed. This rate will provide a retro reflectivity rating of 275 mcd/m2/lux for white.

Equipment

Epoxy

The equipment required to dispense and apply epoxy paint for pavement markings in the City of Edina is specialized in its nature and is designed for a dedicated work crew due to the technical specifications of the equipment and the knowledge needed for optimal bonding of product. In general the chassis mounted system is composed of a 5 gallon solvent tank, 8 cubic foot bead tank, 20 gallon color tank and 20 gallon catalyst tank. All pressures, temperatures, ratios and other technical adjustments and measures are operated from a control module located on the rear of the unit. The gun assembly consists of an overhead swinging boom with a 25 foot hose.

- Due to the technical characteristics of the products this unit requires a minimum 2 man dedicated work crew that has undergone specific training and has carnal knowledge of the materials operational limitations and changing work environments.
- Work crews may require a Hazardous material endorsement on driver's license depending on the volumes that are being transported.
- The science behind the chemical composition of the colored Epoxy and catalyst make it imperative for operators to immediately recognize changes in the external environment of the project including road surfaces, temperatures, application rates etc.
- Also as important operators must immediately recognize changes in chemical composition as it continually needs to be adjusted using the control module. Failure to recognize changes in an operator's external or internal environment will lead to equipment malfunction, product malfunction or combination of both that will leave situations virtually irreversible depending on state of the product. (i.e. if the epoxy has mixed with catalyst or not)
- Clean out of product is relatively the same time frame as is need for latex but is much more hazardous due to the chemicals needed for the task. 100% pure Xylene is required to clean unit daily. This product and that of the color and catalyst are a hazardous material and have to be contained in a containment unit during cleanout process.
- Additional storage consideration is required for the color and catalyst since products are highly corrosive and flammable it is recommended that product is not stored on the floor of the apparatus bay of the public works building.

Latex

The equipment required to dispense and apply latex paint for all pavement markings in the City of Edina consist of a 6'x8' trailer housing a line laser striping system with a feeder tube for paint to be pumped through, 50 foot hose reel with a spray gun attached and a tub of beads that holds roughly 250 lbs. The machine is very simple to prime taking less than 5 minutes in order to be ready to apply paint to road surface.

- Equipment is less complicated and virtually there is no changing of controls when applying in different environmental conditions. Only aspects that can be adjusted are by the operator applying a thinner layer of paint known as a "Fog Coating" in weather that is less than ideal.
- There isn't any additional equipment required for storage or cleaning of product from the unit.
- Due to the simplification of applying Latex work crews can be split up for other tasks throughout the course of a day. The machine and application process does not require a dedicated 2 man work crew.

Cost

Epoxy

The City of Edina would need to purchase brand new specialized equipment for Epoxy application. Below are the associated estimates for the purchase of a chassis mounted Epoxy Marking system, unit costs for color, catalyst and beads. All costs presented exclude the maintenance costs of the equipment which in general are relatively higher when dealing with Epoxy applications due to the viscosity and corrosive nature of the products.

- EPO-60 Epoxy Detail Marking System: approx. $135,000-$175,000
  **Chassis that is required for unit to be mounted to is not included in the estimate price
- Fast Cure Epoxy White Color $1,375.00 per 55 gallon drum
- Fast Cure Epoxy White Color $125.00 per 5 gallon pale
- Fast Cure Catalyst $125.00 per 5 gallon pale
- Slow Cure White Color $1,237.50 per 55 gallon drum
- Slow Cure White Color $112.50 per 5 gallon pale
- Slow Cure Catalyst $112.50 per 5 gallon pale
- Glass Beads $14.70 / 50 lb bag $588.00 /2000 lb container

Latex

The City of Edina would not need to purchase any additional equipment for latex application. All equipment is in good working condition and paid for.

- MN State Bid 2014 Mid durable White $458.15 per 55 gallon drum
- MN State Bid 2014 Mid durable White $42.15 per 5 gallon pale
- Glass Beads (Same as Epoxy)

Cost Comparison

Estimated paint costs were determined by examining the quantities of product that were applied to City of Edina roadway in 2013 for crosswalks, arrows, stop bars and bike lane stencils. These quantities do not accurately reflect the amount of product that would be needed to completely paint Edina because painting of all traffic markings could not be completed in 2013 due to weather related implications.

- 2013 500 gallons of white paint were used for crosswalks, turn arrows, bike symbols and stop bars.
- It would cost the city a minimum of $15,500 to purchase Fast cure White color Epoxy and the required catalyst
- It would cost the city a minimum of $4,125 to purchase Mid durable Latex.

Pavement Marking Maintenance and Associated Costs

Epoxy

Using Epoxy for pavement markings has a life span of about 3-5 years. After the first year of application many organizations have found the amount of retro reflectivity to fall off drastically from the initial 300 mcd/m2/lux. This drop in reflectivity renders the pavement marking almost impossible to see at night and after time is considered to be a "dead line". The recommended maintenance practice for pavement markings that suffer from this condition is the spraying of latex over the epoxy line to enhance the retro reflectivity for the rest of the lifespan of the product. This means applying latex every year after the initial installation of epoxy.

- Using a 4 year life cycle of Epoxy material the City of Edina would spend a minimum of $15,500 on product and catalyst alone for the first year of application. This excludes the required specialized equipment, labor and beads. And incur a minimum cost of $4,125.00 on product alone every subsequent year through the re-installation of Epoxy at year 4. This 4 year life cycle using epoxy, strictly considering paint and product costs assuming prices do not increase year to year is a minimum total of $39,250.00.

Latex

Using Latex paint for pavement markings has a life span that ranges from 9-36 months. The City of Edina currently uses a 1 year life cycle for re-striping activities. This means that all pavement markings are re-striped every year.

- Using the same 4 year life cycle where Latex is re-applied yearly the city would spend a minimum of $4,125.00 on product for the first year of application. This excludes the required labor and beads. The city would incur the same minimum costs for every subsequent year after assuming prices do not increase. This 4 year life cycle using Latex, strictly considering paint costs assuming prices do not increase year to year is a minimum total of $16,500.00.

After examining the costs associated with each respective application the costs to apply epoxy based on the life span of the product are more than double than that of applying Latex every year.

Recommendation

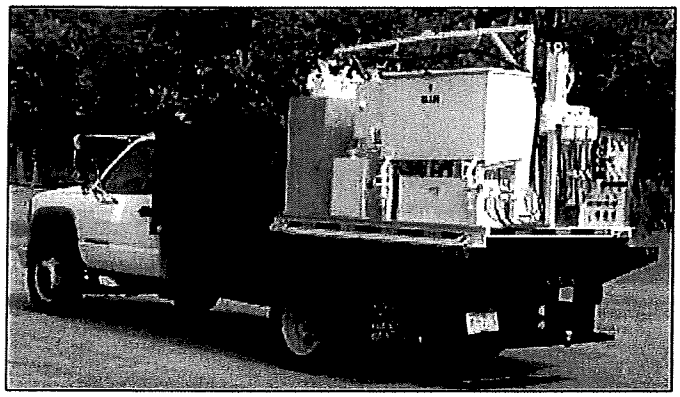
The maintenance of pavement markings can be overwhelming for municipalities depending on the desired methods of application and workloads. After talking with technical experts, reviewing MNDOT reports and analyzing the costs associated with using Epoxy Vs. Latex, its apparent that it is not cost effective for the City of Edina to use Epoxy as a viable maintenance option. The high cost of product, high cost of entry and purchasing the necessary equipment is too great for the City of Edina to consider as a cost effective option. There are areas within the city that may benefit from Epoxy application but due to cost and resources, research should be conducted pertaining to the use of contractors rather than considering the purchase of equipment to execute the project ourselves. It is our professional opinion that Epoxy application is not a viable option for the City of Edina to execute in house. Our professional recommendation is to continue current maintenance practices and focus research efforts on more effective striping policies/schedules and other durable products that may be cost effective for Edina and its residents.

www.m-bco.com

Intermediate Palletized Epoxy Striper

EPO-60

Approx $135,000 - $175,000



Epoxy Detail Marking

Truck or Trailer not included

Unit Configuration

- Platform mounted for installation on truck bed
- Construction : channel iron and structural steel
- Platform dimensions: 72" x 92"

Material Tanks

- "A" - White 20 gallon A.S.M.E. steel
- "A" - Yellow 20 gallon A.S.M.E. steel
- "B" - Catalyst 20 gallon A.S.M.E. steel
- Material tanks equipped with fill port and cap to allow filing without removing lids
- Tanks are water jacketed and insulated to warm material

Material Pump

- Graco Visount II, havy duty plural component, hydrualically driven, 2:1 ratio mix
- Rechargable accumulators for each pump system and all gauges

Power Pack

- Kubota 3 cylinder diesel engine 22HP
- 12 gallon fuel tank
- Air compressor 10.8 CFM
- Electric start
- Water circulation pump

Heating System

- 80,000 BTU diesel fired
- Control gauges for temperature in tanks and heat exchangers
- Heat exchangers for "A" and "B" material
- Heated hose assembly

Gun Assembly

- Binks 43P static mixer gun mounted on swivel boom with 25 foot hose

Solvent System

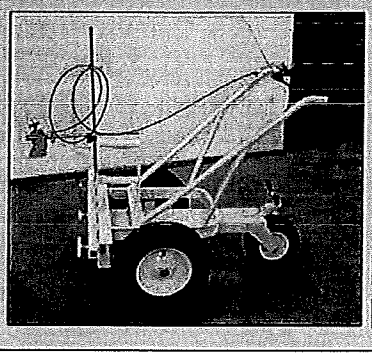
- 5 gallon stainless steel air operated pump used to flush gun

Bead Tank

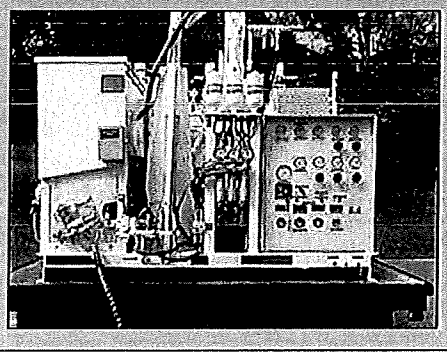
- 8 cubic foot capacity aluminum construction

Control Panel

- All controls built into a swing out control center for easy access
- Controls, gauges, temperature controls, pressure gauges and engine system controls



Detail Hand Cart



Rear View

Prices based on min 20,000 Linear ft lower qty will result in higher price* (1999 dollars)+

MATRIX OF MATERIALS

	Estimated Cost Per Linear Foot[2]	Estimated Life of the Product[3]	Application Temperature	Initial Retroreflectivity[5]	Advantages	Disadvantages
Conventional Products[1]						
Latex	$0.03 - $0.05	9 – 36 months	Air and pavement temperature of 50° F and rising	▪ 275 for white – 180 for yellow with 8 pounds of beads per gallon of paint	▪ Inexpensive ▪ Quick-drying ▪ Longer life on low-volume roads ▪ Easy clean-up and disposal ▪ No collection of hazardous waste products	▪ Short life on high-volume roads ▪ Subject to damage from sands/abrasives ▪ Bead application required ▪ Does not adhere as well to concrete ▪ Pavement must be warm or it will not adhere
Alkyd – New Formula	$0.03 - $0.05	9 – 36 months	Air and pavement temperature of 32° F	▪ 275 for white – 180 for yellow with 8 pounds of beads per gallon of paint	▪ Inexpensive ▪ Quick-drying ▪ Longer-life on low volume roads ▪ Works in cold temperatures	▪ Short life on high-volume roads ▪ Subject to damage from sands/abrasives ▪ Bead application required ▪ Does not adhere as well to concrete ▪ Is highly flammable and requires the use of solvents for clean-up ▪ Has a bad smell
Durable Products						
Mid-durable Paint Latex (conventional)	$0.08 - $0.10	9 – 36 months[4]	Air and pavement temperature of 50° F and rising	▪ 275 for white – 180 for yellow with 8 pounds of beads per gallon of paint	▪ Inexpensive ▪ Quick-drying ▪ Longer life on low-volume roads ▪ Easy clean-up and disposal ▪ No collection of hazardous waste products	▪ Short life on high-volume roads ▪ Subject to damage from sands/abrasives ▪ Bead application required ▪ Does not adhere as well to concrete ▪ Pavement must be warm or it will not adhere
Epoxy	$0.20 - $0.30	4 years	Air and pavement temperature of 50° F and rising	▪ 300 for white – 200 for yellow with 25 pounds of beads per gallon of epoxy	▪ Longer life on low- and high-volume roads ▪ More retroreflective	▪ Slow-drying ▪ Requires coning and/or flagging during application ▪ Heavy bead application required – may need to be cleaned off of roadway ▪ High initial expense ▪ Subject to damage from sands/abrasives

City of Edina
Comprehensive Striping Outline for 2013

City Maintained Crosswalks:	As of 12/13	130
Total Blocks:	Conservative Estimate	1,100 individual blocks
City Maintained Arrows:	As of 12/13	365
City Maintained Stop Bars:	As of 12/13	104
*(Have not been totally accounted for)		
City Maintained Bike Lane Stencils:	As of 12/13	586
*(excluding Tracy Ave from Vernon to Benton Ave)		
*(This figure is counting the Bike stencil and arrow separate, two different forms)		

Lane Striping:

Total Lane Miles of Yellow Painted for year 2013:	30 miles
Total Lane Miles of White Painted for year 2013:	28.5 miles

Total Paint Consumption for Crosswalks, Arrows and Bike Stencils:	500 Gallons of White
Total Paint Consumptions for Lane Striping:	605 Gallons of Yellow 385 Gallons of White

**(These totals reflect the amount of product that has been applied to the roadways for the year of 2013. Not all surfaces were able to be painted during year due to weather, therefore the totals for the amount of applied product do not accurately reflect the amount of product required to complete the entire roadway system of the City of Edina.)

ENNIS-FLINT
A Traffic Safety Solutions Company

QUOTATION

Salesman	Jeremy Crow
Email	jcrow@ennistraffic.com
Phone	612-508-8229
Inside Sales	Jimmie Fields
Email	jfields@ennistraffic.com
Phone	(469) 522-5864
Fax	(336) 475-7900

Date: 2/28/2014

Customer ID: 20640

To	Ship To
Travis Gossard, Public Service	City of Edina
City of Edina	4801 West 50th Street
4801 West 50th Street	Edina, MN 55424-1330
Edina, MN 55424-1330	
Phone: 952-826-0376	
EMAIL: Tgossard@EdinaMN.gov	

WE PROPOSE TO SUPPLY THE FOLLOWING SPECIFIED PAVEMENT MARKING PRODUCTS:

Part #	Description	Unit of Measure	Unit Price	Price Per Drum
999211	White HPS-2 Epoxy Traffic Paint/ 55 gallon drum	Gallon	$ 22.50	$ 1,237.50
999212	Yellow HPS-2 Epoxy Traffic Paint/ 55 gallon drum	Gallon	$ 22.50	$ 1,237.50
999299	Catalyst HPS-2 in 55 gallon drum	Gallon	$ 22.50	$ 1,237.50
999311	White HPS-3 Epoxy Traffic Paint/ 55 gallon drum	Gallon	$ 25.00	$ 1,375.00
999312	Yellow HPS-3 Epoxy Traffic Paint/ 55 gallon drum	Gallon	$ 25.00	$ 1,375.00
999399	Catalyst HPS-3 in 55 gallon drum	Gallon	$ 25.00	$ 1,375.00

TERMS & CONDITIONS OF SALE

FOB: DESTINATION

Delivery: 30 days ARO

FINANCIAL TERMS: Net 30

All sales are subject to Ennis Paint, Inc's Standard Terms and Conditions of Sale, a copy of which can be found at: http://www.ennistraffic.com/files/Ennis-Sales-Terms-and-Conditions.pdf

These prices are subject to change without notice.

NOTES:

A 3% fee is applicable to credit card orders.

We at Ennis Paint would like to thank you for this opportunity, and look forward to working with you.
If we can be of service in any way, please do not hesitate to call your Customer Account Representative,

Submitted By:

Jimmie Fields